USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2003NJ38B

Title: Investigation of Design Parameters for Engineered Rhizoremediation Systems to Treat Contaminated Sediments In Situ

Project Type: Research

Focus Categories: Sediments, Treatment, Toxic Substances

Keywords: rhizoremediation PAHs estuarine sediments

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Matching Funds: $38745.00

Congressional District: 6

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Abstract: This proposal will investigate the key design features of a model engineered rhizoremediation system for remediation of New Jersey sediments contaminated with complex mixtures of anthropogenic organic pollutants.

Contamination of estuarine environments by toxic organic contaminants, such as polyaromatic hydrocarbons
(PAHs) and related petroleum hydrocarbons, has become a significant environmental concern in NJ due to industrial
activities and has resulted in widespread contamination of estuarine sediments. Ex situ treatment methods, such as
composting and soil washing, are by their very nature disruptive and costly. In situ remediation is an attractive alternative,
but methods based on injection of surfactants or chemical oxidants (which have been employed in several large-scale
sediment remediation projects) can be as expensive and ecologically disruptive as ex situ approaches

requiring excavation.

In contrast, in situ approaches that rely on the biodegradative activities of microorganisms are generally viewed as being
less costly and less disruptive of the ecosystem. Nevertheless the overall rates of intrinsic biodegradation of target
contaminant compounds (e.g., PAHs) in estuarine sediments is often limited both by the reduced availability of oxygen
in the sediments and by the reduced bioavailability of the contaminant molecules to the biodegradative microbes owing
to the sequestration of the contaminants into the complex natural organic matter matrix of the sediment material.

However, vascular plants that are adpated to thrive in the tidal marsh zones of such estuarine habitats establish
microniches that can favor enhanced microbial activity in their rhizosphere. Hence, the overall goal of this research project is to combine the advantages of appropriately selected plant species together with selected rhizosphere-associated microbial consortia to produce an engineered rhizoremediation system designed to enhance the in situ degradation of particular suites of target contaminants.

Selected species of salt marsh plants (viz., species of Spartina and Phragmites)will be combined together with
constructed microbial consortia. The members of the microbial consortia will be selected for their ability to
enhance desorption of target pollutants from sediment material and for their ability to degrade target pollutants in the
rhizosphere. The basic hypothesis being tested is that microbial degradative activity towards target pollutants will be
enhanced in the rhizosphere via an overall enhancement of microbial metabolic activity as a consequence of oxygen
cycling and nutrient provision from the plant's root system.
